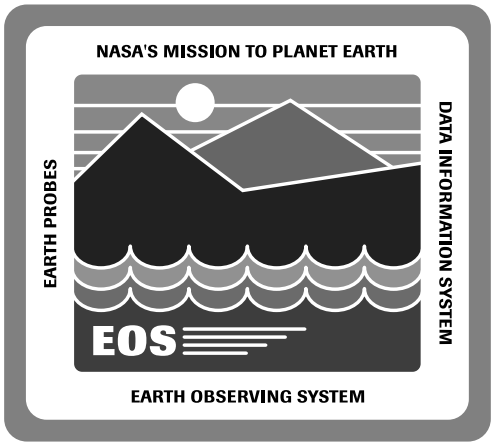


FOS Acceptance Testing

Mark Abernathy

18 October 1995

FOS CDR Roadmap

FOS Overview

FOS CDR Overview
- FOS CDR goals
- Driving requirements

Engineering Activities
- Activities since PDR
- FOS team approach

System Architecture
- Overview
- Features

FOS System Architecture

IST
- Capabilities
- Plans

Hardware Design
- Computers
- Peripherals

Network Design
- EOC LAN
- IST Connectivity

FOS Infrastructure
- Mgt Services
- Comm Services

Segment Scenarios
- End-to-End Flow
- Subsystem Interfaces
- Building block linkage

FOS System Design

Subsystem Design
- Detailed design
- FOS functions/tools
- Subsystem design features

RMA
- RMA allocation
- FMEA/CIL

FOT Operations

Operations Overview
- EOC facilities
- FOT positions

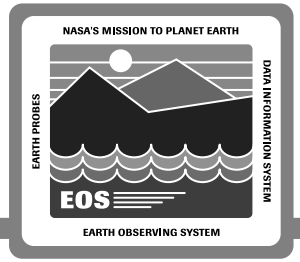
Operational Scenarios
- End-to-end flow
- Operations perspective
- FOT tool usage

Road to Launch

Development
- Release Plan
- Development approach

Testing
- Test approach
- Test organization

Agenda



ECS Acceptance Test Program

Test Development Process

Acceptance Test Plans

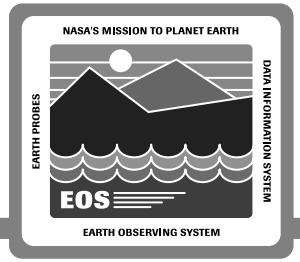
Test Tools

Test Objectives

Acceptance Test Overview by Release

Test Reporting

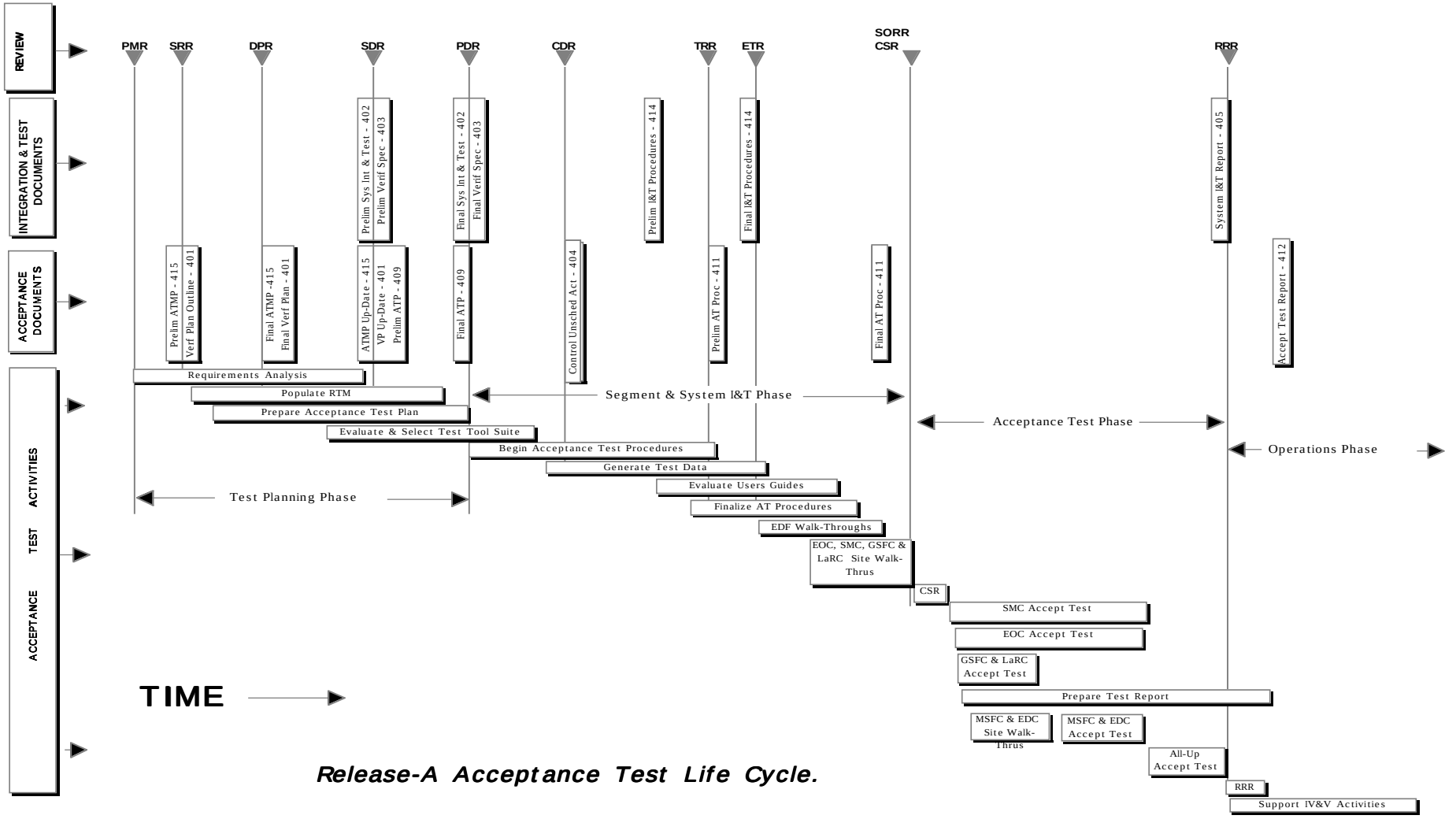
ECS Acceptance Test Program



Performed at all ECS sites (DAAC's, SMC & EOC)

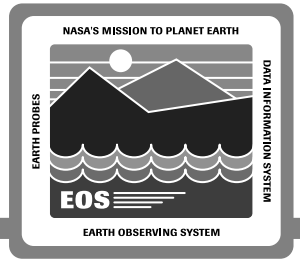
- **Final ECS test activity prior to delivery to ESDIS**
- **Verifies release functionality and performance**
- **Lead by the Independent Acceptance Test Organization (IATO)**
- **Testing starts after the Consent to Ship Review (CSR)**
- **Results presented at the Release Readiness Review (RRR)**
- **Acceptance test process is defined in:**
  - **Acceptance Test Management Plan (DID 415)**
  - **Verification Plan (DID 401)**
  - **Release A and B Acceptance Test Plans (DID 409)**
- **Acceptance test implemented in accordance with:**
  - **Release Acceptance Test Procedures (DID 411)**
    Site specific volumes (including EOC/IST)
  - **Test execution with EOC, SMC & DAAC M&O support**

Acceptance Test Life Cycle



Release-A Acceptance Test Life Cycle.

Test Development Process



Level 3 Requirements Analysis

- **Decomposition**
- **Interpretation**
- **Verification method assignment**

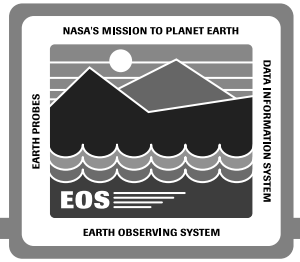
Requirements Criticality Assessment

- **Mission critical**
- **Mission essential**
- **Mission fulfillment**

Acceptance Test Scenario Definition

- **Operations Concepts**
- **User characterization models**
- **Segment scenarios**
- **Requirements mapping to scenarios**

System Acceptance Test Plans



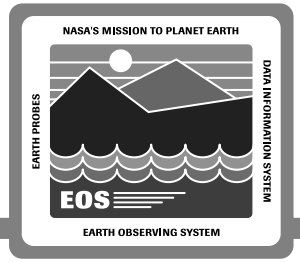
Outlines the Acceptance Test process by Release

- **Preliminary plans detailed to Scenario Level**
- **Delivered at SDR/RIR**
- **Final plans detailed to Test Case Level**
  - **Delivered at PDR/IDR**
- **Release-B Builds on Release-A Scenarios**
- **Followed by Preliminary Acceptance Test Procedures documents delivered at TRRs**

Uses ECS source material

- **F&PRS, IRDs, ICDs**
- **Technical Baseline**
- **ECS Operations Concepts Document**
- **Release Plan**

System Acceptance Test Plans
(cont.)



Mapped into five broad scenario groups

- **System Management, Push, Pull, Flight Operations & End-to-End**

Three Scenario Groups involve testing of the FOS

- **Flight Operations**
- **System Management**
- **End-to-End**

Scenario Groups broken down into Scenarios, Sequences and Test Cases

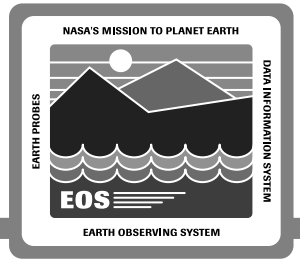
Testing at the SMC and GSFC DAAC requires EOC support

- **Especially for Release B**

FOS acceptance test activities divided into three windows

- **EOC Test Window**
- **EOC & SMC Test Support Window**
- **ECS End-to-End Acceptance Test Window**

Test Tools



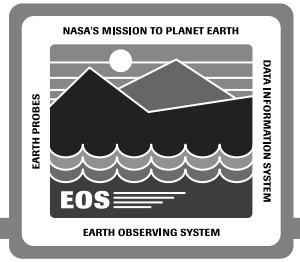
Test Management

- **Requirements tracing - RTM**
- **Test Automation - XRunner**
- **Performance Testing - LoadRunner**
- **Configuration Management - CLEARCASE**
- **Nonconformance Reporting - DDTS**

Test Environment

- **Test performance monitoring - HPOpenview (Release A & B)**
- **Lockheed/Martin Project Database (Release A & B)**
- **Test data drivers - for real time telemetry (Release A)**
- **Interface Simulators (ETS for Release B)**

FOS Release A Capabilities



Scheduling

Planning & Scheduling
BAP Definer Tool
Detailed Activity Schedule

Command Mgt
Uplink Load Generation
ATC Load Generation
Ground Sched Generation
Load Manager
Microprocessor Loads
RTS Load Builder

Real-Time

Resource Mgt
String Manager
Command Authority
Ground Control Privilege

Telemetry
Decom Engine
Mirrored Telemetry
Parameter Server

Command
Cmd Validation, Generation and Uplink

Real-Time Contact Mgt
NCC GCMRs, NCC Test Msg

Analysis

FUI
Analysis Request Tool
Analysis Report Generation

Analysis
Request Manager
Dataset Generation
Expert Advisor

Data Mgt
Data Archive

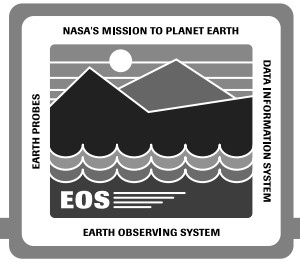
Support Services

ECL	Screen Management	Display Builder	Time Selector	DB Generation
Events	Window Manipulation	Procedure Builder	Quick Analysis	(Activities, Cmd, Tlm)
Help	Status Window	Room Builder	Ground Script Control	DB Edit

Infrastructure

Message Passing	Name Services	Network Services	Interface Connectivity
Security Services	Directory Services	Management Services	Time Services

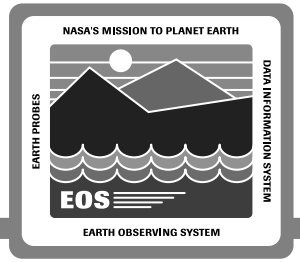
Release A FOS Acceptance Test Objectives



Acceptance testing is designed to provide a level of confidence in the initial release of the FOS by:

- **Simulating operational conditions to the extent possible:**
  - **Verify all FOS mission critical functions implemented in Release A**
  - **Perform initial testing of external interfaces**
  - **Verify functionality of the EOC within the context of the entire ECS (End-to-End testing)**
  - **Conduct performance testing to verify applicable timing, throughput and capacity requirements are met**

Release A Test Scenarios

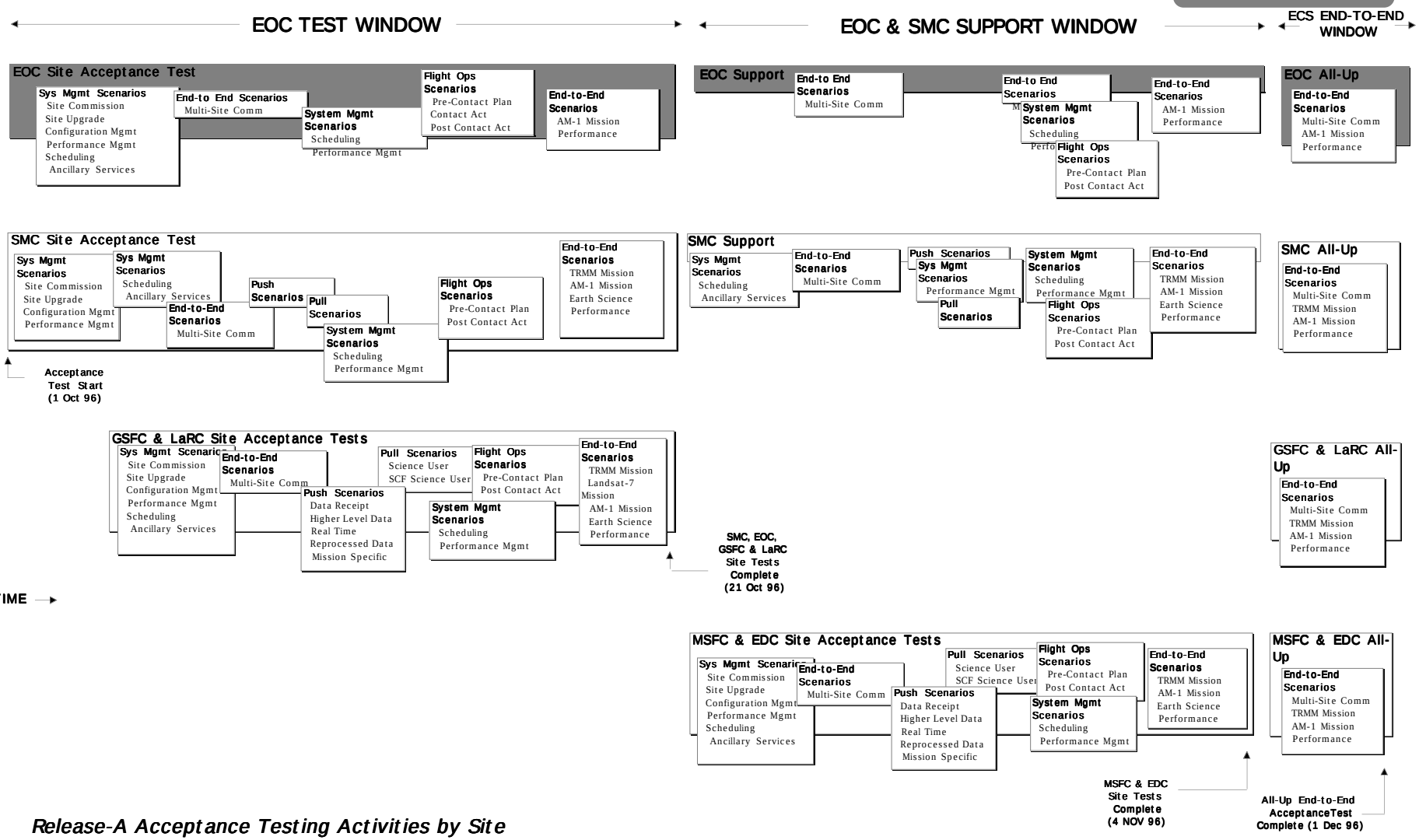


FOS Scenarios

- **Pre-Contact Scenario - Initialize system resources to an operational state ready for contact**
- **Contact Scenario - Establish spacecraft contact, transmit commands for spacecraft and instruments and initialize reception of recorded health and housekeeping data**
- **Post-Contact Scenario - Post-contact actions leading to an orderly return of FOS resources, telemetry analysis and trend analysis**

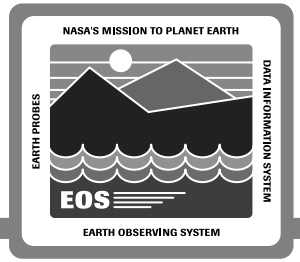
Note: when available, testing will use operational EGS components. Otherwise, scenarios for Release A will rely on test drivers.

Release A Acceptance Test Time-Line



Release-A Acceptance Testing Activities by Site

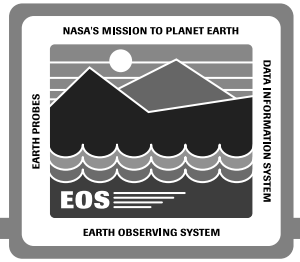
Release A Test Scenarios (cont.)



In addition to FOS Specific Scenarios, two other scenario groups involve tests with the EOC for Release A

- **System Management Scenarios related to EOC**
  - **Site Commission Scenario**
  - **SMC/EOC Scheduling Scenario**
  - **Configuration Management Scenario**
  - **Performance Management Scenario**
- **ECS End-to-End Scenarios related to EOC**
  - **Multi-Site Intercommunications and Interoperations Scenario**
  - **AM-1 End-to-End Scenario**

FOS Release B Capabilities



Scheduling

Planning & Scheduling
Timeline Tool
Planning Aids Mgt
TDRS Scheduling
Activity Constraint Check
What-If

Command Mgt
Cmd Constraint Check
Load Catalog
Load Reports
Generate Patch Loads
Memory Mgt/Compares

Real-Time

Resource Mgt
String Cfg Change Requests
Resource Monitor
Failure Recovery

Telemetry
Derived Parameters, Selective Decom, Tailored Telemetry
S/C State Check
Memory Dump

Command
Cmd Verification
Load Processing

Real-Time Contact Mgt
NCC ODMs, EDOS CODAs

Analysis

FUI
Standing Orders

Analysis
Clock Correlation
Solid State Recorder Mgt
S/C Activity Log
System Statistics
User-Defined Algorithms

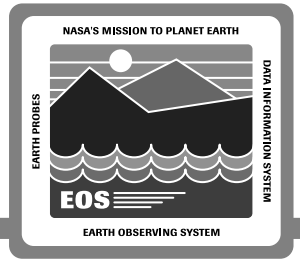
Data Mgt
Triggers
Queue Mgr

Support Services

User Customization	Report Browser/Editor Tool	DB Backup/Restore	DB Reporting
E-Mail	Quick Msg	Archive Events	DB Maintenance
Document Reader	Display Builder (schematics)	Event History Tool	Data Mover

Infrastructure
Release A Capabilities
Additional Management and Communication Services

Release B FOS Acceptance Test Objectives



Assess the capability of the FOS to support AM-1 launch and in-orbit operations by:

- **Rigorous testing of the FOS software and hardware using scenarios that simulate as near as possible "real" operational conditions:**
  - **Verify all FOS mission critical functions in an operational environment**
  - **Extensive testing of external interfaces using either the real external system or a simulator (e.g . ETS)**
  - **Verify functionality of the EOC and ISTs within the context of the entire ECS (End-to-End testing)**
  - **Performance testing to verify all timing, throughput and capacity requirements are met**

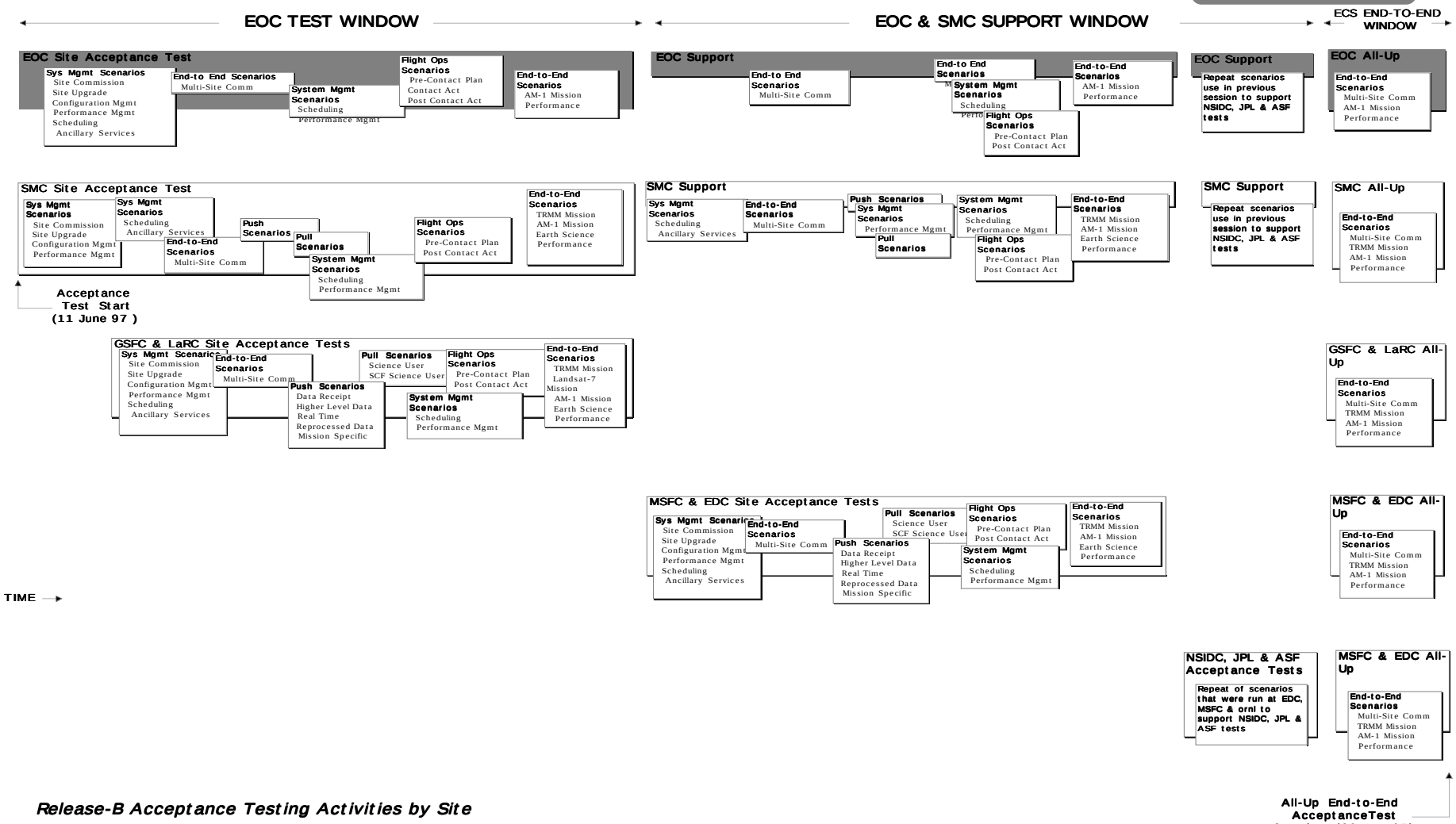
Release B Test Scenarios

FOS Scenarios - Builds on same three Release A scenarios

- **Pre-Contact Scenario - Initialize system resources to an operational state ready for contact**
- **Contact Scenario - Establish spacecraft contact, transmit commands for spacecraft and instruments and initialize reception of recorded health and housekeeping data**
- **Post-Contact Scenario - Post-contact actions leading to an orderly return of FOS resources, telemetry analysis and trend analysis**

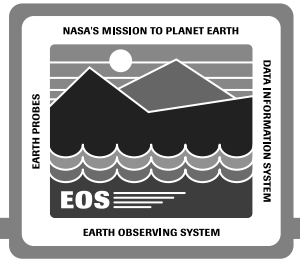
Note: scenarios for Release B will use simulators and EGS operational elements when feasible, to produce a "realistic" scenario

Release B Acceptance Test Time-Line



Release-B Acceptance Testing Activities by Site

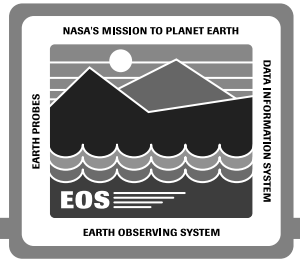
Release B Test Scenarios (cont.)



In addition to FOS Specific Scenarios , two other scenario groups involve tests with the EOC for Release B

- **System Management Scenarios related to EOC**
  - **Site Upgrade Scenario**
  - **SMC/EOC Scheduling Scenario**
  - **Configuration Management Scenario**
  - **Performance Management Scenario**
- **ECS End-to-End Scenarios related to EOC**
  - **Multi-Site Intercommunications and Interoperations Scenario**
  - **AM-1 End-to-End Scenario**
  - **ECS/EOC System Performance Scenario**

Test Reporting



Release Readiness Review

- **Presentation on the results of all acceptance tests**
- **Release Readiness Presentation Package (DID 704)**

ECS System Acceptance Test Report (DID 412)

- **Preliminary at Release Readiness Review**
- **Documents the results of all tests, including**
  - **Tests that passed without error**
  - **Tests that passed with exceptions/modifications**
  - **Discrepancies or tests that failed**
  - **Recommendations for additional tests or documentation changes, if necessary**